

Districts.	Accumulated departures.	Accumulated precipitation.	Districts.	Accumulated departures.	Accumulated precipitation.
	Inches.	Perct.		Inches.	Perct.
North Dakota.....	+ 3.00	129	New England.....	- 3.60	84
Missouri Valley.....	+ 0.20	101	Middle Atlantic.....	- 1.00	95
Middle Plateau.....	+ 1.70	123	South Atlantic.....	- 5.30	80
North Pacific.....	+ 5.30	116	Florida Peninsula.....	- 0.10	99
Middle Pacific.....	+ 2.70	114	East Gulf.....	- 4.50	82
			West Gulf.....	- 6.20	73
			Ohio Valley and Tenn.....	- 6.70	74
			Lower Lakes.....	- 0.30	98
			Upper Lakes.....	- 2.40	85
			Upper Mississippi.....	- 0.70	96
			Northern Slope.....	- 0.40	95
			Middle Slope.....	- 2.60	79
			Abilene (southern Slope).....	- 6.90	48
			Southern Plateau.....	- 0.80	70
			Northern Plateau.....	- 0.80	92
			South Pacific.....	- 1.90	76

Details as to *excessive precipitation* are given in Tables XII and XIII.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 1, 2, 22, 26. Arizona, 20, 25, 29, 30. Arkansas, 1, 2, 8, 17, 21. Colorado, 2, 5, 6, 9, 10, 19 to 25, 28, 30. Georgia, 1, 4, 10, 16. Idaho, 1, 2, 3, 5, 8, 15, 17, 18, 27, 29, 30. Illinois, 6, 7, 8, 17, 19, 24, 27. Indiana, 3, 4, 8. Iowa, 5, 6, 7, 16, 20, 23, 24, 25, 27, 28. Kansas, 1, 3, 4, 6, 16, 17, 18, 20 to 25, 27. Kentucky, 5, 8, 12, 16, 17. Maine, 11, 18. Maryland, 16. Massachusetts, 21. Michigan, 2, 5, 7, 14, 25. Minnesota, 4, 5, 6, 18, 24, 26, 27. Mississippi, 1, 16. Missouri, 1, 6, 7, 17, 21, 22, 23, 25. Montana, 3, 4, 17, 22, 23. Nebraska, 3 to 7, 16, 19, 20, 21, 24 to 27, 30. New Hampshire, 11, 21. New Jersey, 9, 18, 21. New Mexico, 22, 25, 28. New York, 14. North Carolina, 9, 13. North Dakota, 2, 15, 16, 20, 21, 27. Ohio, 3, 6, 7, 11, 13, 14, 15, 25. Oklahoma, 7. Oregon, 5, 9, 16, 29, 30. Pennsylvania, 16, 17, 20. South Dakota, 4, 6, 10, 14 to 17, 20, 22, 29, 30. Tennessee, 1, 15. Utah, 1, 2, 3, 16, 22, 29. Virginia, 15, 18. Wisconsin, 6, 7, 14, 15, 18, 19, 24, 25, 27. Wyoming, 17, 18, 23, 24.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 17 regular stations of the Weather Bureau by its photographic, and at 23 by its thermal effects. At one station records are kept by both methods. The photographic record sheets show the apparent solar time, but the thermometric sheets show seventy-fifth meridian time; for convenience the results are all given in Table XI for each hour of local mean time.

Photographic and thermometric registers give the duration of that intensity of sunshine which suffices to make a record, and, therefore, they generally fail to record for a short time after sunrise and before sunset, because, even in a cloudless sky, the solar rays are then too feeble to affect the self-registers. If, therefore, such records are to be used for determining the amount of cloudiness, they must be supplemented by special observations of the sky near the sun at these times. The duration of clear sky thus specially determined constitutes the so-called twilight correction (more properly a low-sun correction), and when this has been applied, as has been done in preparing Table XI, there results a complete record of the clearness of the sky from sunrise to sunset in the neighborhood of the sun. The twilight correction is not needed when the self-registers are used for ascertaining the duration of a special intensity of sunshine,

but is necessary when the duration of cloudiness is alone desired, as is usually the case.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table XI.

COMPARISON OF DURATIONS AND AREAS.

The sunshine registers give the *durations* of effective sunshine whence the duration relative to possible sunshine is derived; the observer's personal estimates give the percentage of *area* of clear sky. These numbers have no necessary relation to each other, since stationary banks of clouds may obscure the sun without covering the sky, but when all clouds have a steady motion past the sun and are uniformly scattered over the sky, the percentages of duration and of area agree closely. For the sake of comparison, these percentages have been brought together, side by side, in the following table, from which it appears that, in general, the instrumental records of percentages of durations of sunshine are almost always larger than the observers' personal estimates of percentages of area of clear sky; the average excess for June, 1896, is 12 per cent for photographic and 16 per cent for thermometric records.

The details are shown in the following table, in which the stations are arranged according to the greatest possible duration of sunshine, and not according to the *observed* duration as heretofore.

Difference between instrumental and personal observations of sunshine.

Stations.	Apparatus.	Total possible duration for the whole month.	Personal estimated area of clear sky.	Instrumental record of sunshine.			
				Photographic.	Difference.	Thermometric.	Difference.
		<i>Hrs.</i>	%	%	%	%	%
Bismarck, N. Dak.....	P.	475.6	60	67	+ 7	...	...
Helena, Mont.....	P.	475.6	68	71	+ 3	...	...
Portland, Oreg.*.....	T.	471.7	61	62	+ 1	61	0
Eastport, Me.....	P.	466.7	45	60	+ 15	...	...
Minneapolis, Minn.....	T.	466.7	...	...	...	73	...
Northfield, Vt.....	P.	463.5	37	51	+ 14	...	...
Portland, Me.....	T.	463.5	38	...	...	60	+ 12
Rochester, N. Y.....	T.	459.9	67	...	...	74	+ 7
Buffalo, N. Y.**.....	T.	459.9	...	...	...	...	...
Boston, Mass.....	T.	456.2	52	...	...	57	+ 5
Chicago, Ill.....	T.	456.2	63	...	...	84	+ 21
Cleveland, Ohio.....	P.	456.2	50	63	+ 13	...	...
Des Moines, Iowa.....	T.	456.2	39	...	...	61	+ 22
Detroit, Mich.....	T.	456.2	61	...	...	70	+ 9
Dubuque, Iowa.....	T.	456.2	45	...	...	71	+ 26
Eureka, Cal.....	P.	451.9	57	58	+ 1	...	...
New York, N. Y.....	P.	451.9	50	...	...	51	+ 1
Salt Lake City, Utah.....	P.	451.9	49	83	+ 34	...	...
Colorado Springs, Colo.....	T.	449.0	44	...	...	54	+ 10
Denver, Colo.....	P.	449.0	50	67	+ 17	...	...
Philadelphia, Pa.....	T.	449.0	37	...	...	67	+ 30
Baltimore, Md.....	T.	445.9	37	...	...	45	+ 8
Cincinnati, Ohio.....	T.	445.9	57	...	...	81	+ 24
Kansas City, Mo.....	P.	445.9	46	56	+ 10	...	...
St. Louis, Mo.....	T.	445.9	49	...	...	71	+ 22
Washington, D. C.....	P.	445.9	44	51	+ 7	...	...
Dodge City, Kans.....	P.	443.1	64	80	+ 16	...	...
Louisville, Ky.....	T.	443.1	45	...	...	73	+ 38
San Francisco, Cal.....	T.	443.1	70	...	...	77	+ 7
Santa Fe, N. Mex.....	P.	437.2	64	79	+ 15	...	...
Little Rock, Ark.....	T.	434.3	48	...	...	77	+ 29
Atlanta, Ga.....	T.	431.5	60	...	...	78	+ 18
Wilmington, N. C.....	T.	431.5	38	...	...	48	+ 10
Phoenix, Ariz.....	P.	428.7	87	98	+ 11	...	...
San Diego, Cal.....	P.	428.7	58	60	+ 2	...	...
Savannah, Ga.....	P.	425.8	29	58	+ 29	...	...
Vicksburg, Miss.....	T.	425.8	70	...	...	77	+ 7
New Orleans, La.....	T.	420.9	62	...	...	62	0
Galveston, Tex.....	P.	419.0	82	88	+ 6	...	...

* Record by both methods. ** Record incomplete.

WIND.

The *prevailing winds* for June, 1896, viz, those that were recorded most frequently, are shown in Table I for the regular Weather Bureau stations.

The *resultant winds*, as deduced from the personal observations made at 8 a. m. and 8 p. m., are given in Table IX. These latter resultants are also shown graphically on Chart IV, where the small figure attached to each arrow shows the number of hours that this resultant prevailed, on the assumption that each of the morning and evening observations represents one hour's duration of a uniform wind of average velocity. These figures indicate the relative extent to which winds from different directions counterbalanced each other.

HIGH WINDS.

Maximum wind velocities of 50 miles or more per hour were reported during this month at regular stations of the Weather Bureau as follows (maximum velocities are averages for five minutes; extreme velocities are gusts of shorter duration, and are not given in this table):

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		<i>Miles</i>				<i>Miles</i>	
Amarillo, Tex	9	64	n.	Huron, S. Dak	6	53	sw.
Do	10	60	se.	Do	13	56	sw.
Do	11	56	n.	Pierre, S. Dak	13	53	sw.
Do	21	52	w.	Do	21	53	w.
Block Island, R. I.	14	64	e.	St. Louis, Mo	21	52	n.w.
Chicago, Ill.	7	50	sw.	San Antonio, Tex.	11	53	n.
Detroit, Mich.	25	50	w.	Sioux City, Iowa	6	56	sw.
Fort Canby, Wash.	7	54	se.				

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table X, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—The dates on which reports of thunderstorms for the whole country were most numerous were: 6th, 243; 7th, 245; 8th, 229; 9th, 200; 17th, 213; 20th, 204; 21st, 335; 24th, 216; 25th, 202.

Thunderstorm reports were most numerous in: Ohio, 424; Missouri, 293; North Carolina, 219; Illinois, 210.

Thunderstorms were most frequent in: Florida, 29 days; Alabama, Colorado, Illinois, Missouri, South Dakota, and West Virginia, 26; Idaho, Iowa, North Carolina, and Ohio, 25.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 20th to the 28th, inclusive. On the remaining twenty-one days of this month 40 reports were received, or an average of about 2 per day. The dates on which the number of reports especially exceeded this average were: 5th, 5; 8th and 11th, 4; 29th, 8.

Auroras were reported by a large percentage of observers in: Delaware, 50; New Hampshire, 30; Maine, 12.

Auroras were reported most frequently in: New Hampshire, 7 days; North Dakota, 5; Minnesota and Wisconsin, 4; Delaware, 3.

CANADIAN REPORTS.

Thunderstorms were reported as follows: Grindstone, 19th; Grand Manan, 21st, 22d; Yarmouth, 9th, 22d; St. Andrews, 21st, 22d; Charlottetown, 22d; Chatham, 4th, 18th; Father Point, 22d; Quebec, 4th, 18th, 21st, 22d, 29th; Montreal, 7th, 21st; Rockliffe, 6th; Toronto, 6th, 7th, 21st, 28th; Port Stanley, 6th, 7th, 8th, 9th, 21st, 25th; Saugeen, 26th; Parry Sound, 5th; Port Arthur, 18th, 27th; Winnipeg, 4th, 15th, 24th, 26th; Minnedosa, 4th, 14th, 16th, 18th, 26th, 27th; Qu'Appelle, 16th, 22d, 26th; Medicine Hat, 5th, 10th; Swift Current, 2d, 3d, 19th, 23d; Banff, 2d; Edmonton, 1st, 2d, 8th, 12th, 16th, 18th, 22d, 26th; Battleford, 2d, 14th, 15th, 18th, 21st, 23d.

Auroras were reported as follows: Father Point, 5th, 7th, 14th, 15th, 16th, 17th; Quebec, 2d, 14th, 15th, 16th, 17th, 26th, 29th; Montreal, 16th; Toronto, 26th; Winnipeg, 8th, 9th; Minnedosa, 1st; Banff, 9th, 11th, 13th, 14th, 21st, 23d; Prince Albert, 9th, 15th, 17th, 30th.

INLAND NAVIGATION.

The *extreme and average stages of water* in the rivers for the current month are given in Table VIII, from which it appears that the Willamette, at Portland, Oreg., remained above the danger line from the 1st to the 25th, being highest, 23.8, on the 23d, 24th, and 25th. The only other cases in which the rivers approached the danger line were the lower Missouri, which rose to within 3 or 4 feet, and the upper Mississippi, which rose to within 1, 2, or 3 feet of the danger line.

On the 6th heavy rainstorms occurred in the interior of Ohio; also in Marshall County, W. Va., and in Belmont County, Ohio, all in the vicinity of Wheeling, W. Va. As a result, the tributaries of the Ohio rose very suddenly. Three lives were lost by drowning and a large amount of railroad property, bridges, trestles, etc., was destroyed.

Destructive rain and wind storms occurred in Minnesota, Wisconsin, Iowa, Illinois, and Missouri. Five persons were drowned, a number were injured by the wind; hundreds of cattle, sheep, and hogs were drowned. Newspaper estimates place the damage at half a million dollars.

METEOROLOGY AND MAGNETISM.

By Prof. FRANK H. BIGELOW.

For a description of the methods of constructing the tables and curves of Chart V, see the WEATHER REVIEW for October, 1895, and January, 1896. The numbers in the columns H. and D. are added respectively to the mean values for Washington and Toronto, i. e., $H=0.18250$; $D=180.0$. The values of the vertical force are omitted, as well as dz , s and a , which depend upon it.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective services.

Snowfall and rainfall are expressed in inches.

Alabama.—The mean temperature was 77.2°, or 0.6° below normal; the highest was 100°, at Ashville on the 26th, 27th, and 30th, at Eufaula on the 29th, and at Goodwater on the 30th; the lowest was 48° at Valleyhead on the 15th. The average precipitation was 5.24, or 0.44 above normal; the greatest monthly amount, 13.15, fell at Daphne, and the least, 1.94, at Opelika.

Arizona.—The mean temperature was 83.6°, or 6.6° above normal; the highest was 127°, at Fort Mojave on the 15th, and the lowest, 35°, at Flagstaff on the 4th. The average precipitation was 0.24, or 0.12 below normal; the greatest monthly amount, 1.81, fell at Fort Huachuca. Nineteen stations reported no precipitation.

Arkansas.—The mean temperature was 77.7°, or 0.8° above normal; the highest was 103°, at Malvern on the 27th, and the lowest, 48°, at Silver Springs on the 3d. The average precipitation was 1.91, or 2.14 below normal; the greatest monthly amount, 4.65, fell at Stuttgart, and the least, 0.10, at Texarkana.

California.—The mean temperature was 72.5°, or 1.7° above normal;